

REPORT
ON
THE MINERAL EXPLORATION
IN
THE SOUTHERN NURATAU AREA
THE REPUBLIC OF UZBEKISTAN
(PHASE II)



JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

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PREFACE

In response to the request of the Government of the Republic of Uzbekistan, the Japanese Government decided to conduct a series of studies involving geological survey, geochemical survey and others related to exploration of ore deposits, for the purpose of examining the potentials of mineral resources in the Southern Nuratau Area, situated some 330 km southwest of Tashkent, the Uzbek capital city, and entrusted the survey to the Japan International Cooperation Agency (JICA).

In view of the geological and mineralogical nature of the intended survey, the JICA commissioned the Metal Mining Agency of Japan (MMAJ) to execute the survey.

The survey started in FY1997 (Phase I) and this Report corresponds to Phase II or the second year (FY1998) of the survey. During Phase II, the MMAJ sent to the Republic of Uzbekistan a two-man survey team for the period from July 14 to October 23, 1998. The field survey was completed, as scheduled, in close collaboration with the Uzbek government agencies concerned and the State Committee of Geology and Mineral Reserves.

The Report summarizes the results of the Phase II survey and is designed to form an integral part of the final survey report to be elaborated.

We should like to take this opportunity to express our sincere gratefulness to the Uzbek government agencies and persons concerned for their valuable cooperation. We are also thankful to the Japanese Ministry of Foreign Affairs, the Ministry of International Trade and Industry, the Embassy of Japan in Tashkent and persons concerned who have rendered assistance and support for the survey.

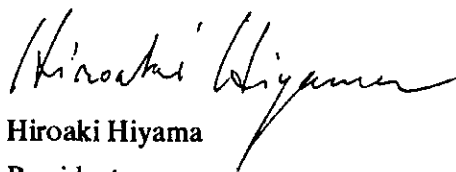
March, 1999



Kimio Fujita

President

Japan International Cooperation Agency



Hiroaki Hiyama

President

Metal Mining Agency of Japan

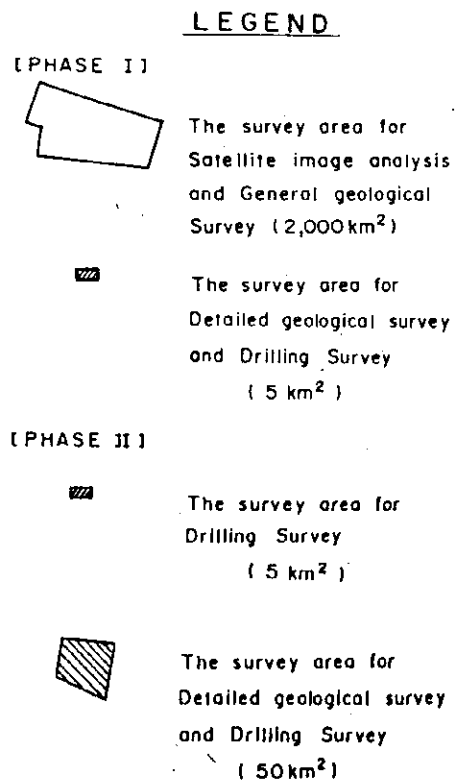
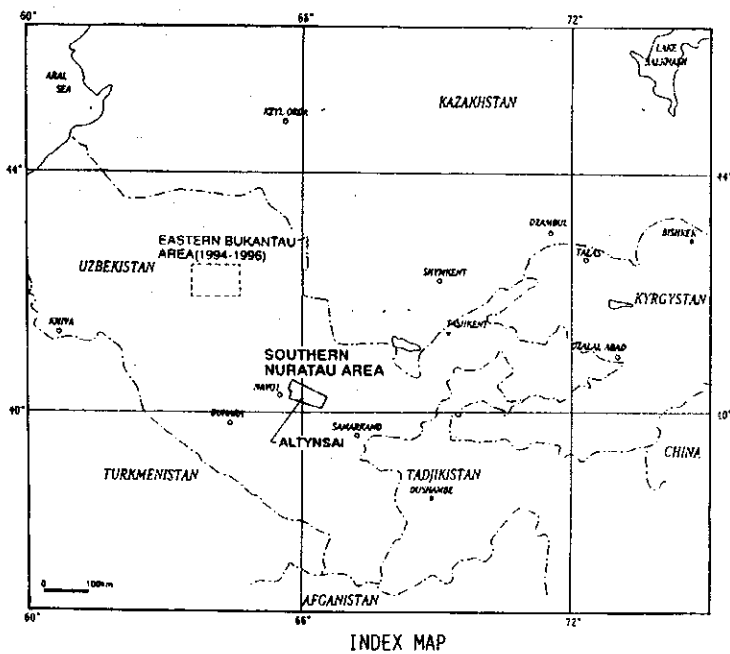
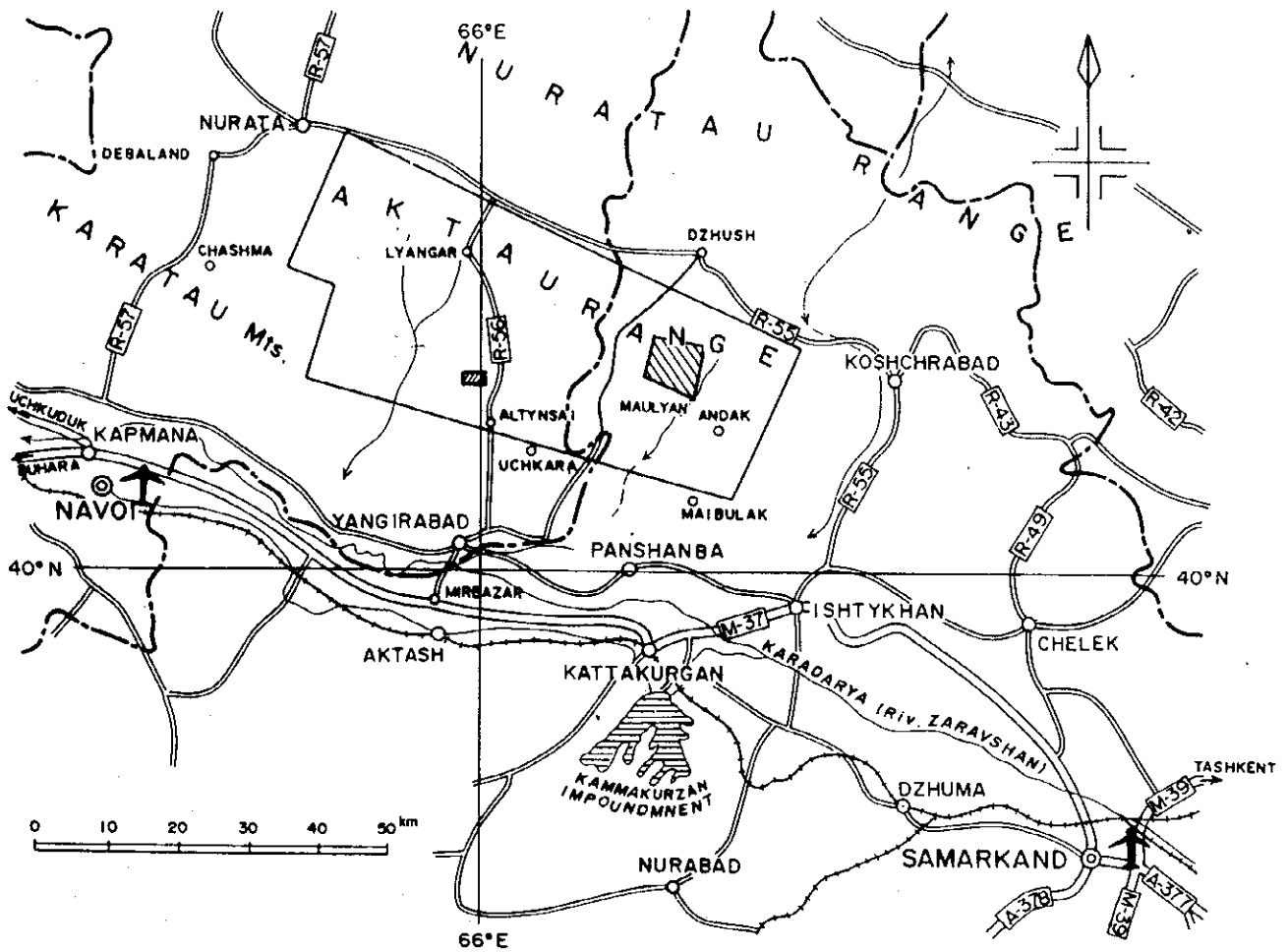


Fig.I-1 Location Map of the Survey Area

РЕЗЮМЕ

Настоящий отчет представляет собой свод результатов Фундаментального исследования по программе сотрудничества в освоении недровых ресурсов на второй год, которое было проведено в Южно-Нуратуском регионе Республики Узбекистан. Основные цели исследования заключались в выяснении геологической обстановки и расположения рудных месторождений в названном регионе, в определении общих направлений исследовательских работ на будущее, проведении переоценки существующих месторождений и составлении плана извлечения недровых ресурсов с них, а также, тем самым, в оказании помощи стране-партнеру в освоении и разработке рудных ресурсов. Работы по разведке на месте были проведены с июля по октябрь 1998 г.

В рамках исследования на первый год в зоне общей площадью 2000 км², назначенной объектом исследования, были проведены изучение и анализ фотоснимков, снятых с борта искусственного спутника, сбор и анализ существующих материалов и информации о недрах, а также геологическая разведка. В Алтынсайском районе также были проведены подробная геологическая разведка по площади 5 км² и разведка с разбуриванием скважин (10 скважин, общая глубина 2451,1 м) на Алтынсайском месторождении.

В рамках исследования на второй год с учетом результатов исследования, проведенного в предыдущем году, и выведенных рекомендаций были проведены геологическая и геохимическая разведка по площади 50 км² в Маулянском районе и разведка с разбуриванием скважин (2 скважины, общая глубина 384,1 м) на Маулянском рудопроявлении. Кроме того, на Алтынсайском месторождении была проведена разведка с разбуриванием скважин (4 скважины, общая глубина 790,4 м).

В следующем приводим результаты исследования на второй год по каждому из районов и рекомендации на третий год:

1) По Алтынсайскому району

(1) Геологическая обстановка и месторождения

- Геология в данном районе состоит из осадочных пород, относящихся к ордовикскому - силурскому периодам, и проникающих в них интрузивных лампрофиров, относящихся к нижне-пермскому - верхне-пермскому периодам. В общем, она представляет складчатую структуру с осью, идущей по направлению ЗСЗ-ВЮВ.
- Месторождения в данном районе являются жильными, на которых золото содержится в кварцевых жилах, ограниченных гармонизирующей с тектонической структурой разломной полосой системы ЗСЗ-ЗЮЗ и пересекающей ее наискось разломной полосой системы СЗ-ЮВ, а также в тонких полосах турмалино-кварцевых жил на серии трещин системы С-Ю.

(2) Участки минерализации

- В пределах полосы протяженностью 2,5 км и шириной 500 - 800 м найдены рудные тела кварцевых жил №1, №2, №5, №8, (северо-западная жила), №9 (Казанбулакская жила) и №10 (Беркутская жила) в осадочных породах, превратившихся в роговые породы. В пределах этой зоны расположения

участков минерализации развиваются полосы тонких турмалино-кварцевых жил системы С-Ю.

- Рудные столбы находятся в зоне, где сосредоточенно располагаются кварцевые жилы на участке пересечения жилы системы ЗСЗ-ВЮВ с разломом системы СЗ-ЮВ и тонкие турмалино-кварцевые жилы системы С-Ю.

(3) Масштаб и длительность месторождения

- Разведкой с разбуриванием скважины MJSN-11 в текущем году, объектом которой был назначен восточный конец (120 м) зоны интенсивной минерализации (полезная ширина 1,6 м, содержание золота 15,3 г/т) в жиле №2 (на стороне дна), найденной при исследовании в предыдущем году, была уточнена длительность месторождения. Однако масштаб минерализации и содержание золота оказались низкими (полезная ширина 1,27 м, содержание золота 3,0 г/т).
- В результате исследования на первый год и разведки в скважине MJSN-13, которые были проведены в целях постижения состояния минерализации полосы тонких турмалино-кварцевых жил системы С-Ю и определения возможности открытой разработки, был выявлен процесс минерализации во многих местах (содержание золота: трасса ~ 23,6 г/т). Однако, в общем, содержание золота оказалось низким и составило не более 0,2 г/т в среднем.
- В текущем году Узбекской стороной была проведена разведка с разбуриванием 4 скважин (С-47, С-50, С-53, С-54), цель которой заключалась в изучении нижнего конца рудного столба, найденного в штреках в жилах №1 и №2. В результате этой разведки было уточнено то, что на глубинах более 100 м (на отметке 600 м над морем) под штреками процесс минерализации ослабляется. Причина такого ослабления минерализации, должно быть, заключается в отпаде основной части рудного тела из-за эрозии.
- Рудное тело (уточненная протяженность 32 м, ширина жилы 1,35 м, содержание золота 8,1 г/т) северо-западной жилы (жилы №8), которое было уточнено в траншее (№40), идущей вдоль жилы на Узбекской стороне, является кварцевой жилой массивной структуры, подобной рудному столбу жилы №1 в штреках. Участок расстоянием 230 м между траншеей, идущей вдоль жилы и отработанного штрека на восточной стороне, а также участок под траншеей (на высоте над морем 860 м), еще не разведаны, и должны быть назначены объектами разведки в дальнейшем.

(4) Процесс минерализации

- Как правило, температуры гомогенизации жидкостных включений в кварцевых жилах систем ЗСЗ-ВЮВ и СЗ-ЮВ, а также в тонких турмалино-кварцевых жилах системы С-Ю, составляют 270°C ~ 370°C, и не показывают значительной разности. Предполагается, что эти кварцевые турмалино-кварцевые жилы формировались в определенный период минерализации и определенных температурных условиях.
- Данные по распределению участков минерализации и пределам

расположения участков роговых пород в достаточной мере совпадают с данными по аномалиям, полученными в результате проведенной Узбекской стороной аэромагнитной разведки. Это совпадение данных указывает на возможность наличия скрытых гранитных пород. Следовательно, можно предположить, что данный участок минерализации был сформирован в результате протекания процесса минерализации, вызванного интрузией гранитных пород.

- Данное месторождение, несмотря на достаточную длительность процесса минерализации, характеризуется большими колебаниями показателей содержания золота по его участкам, и, в общем, имеет низкий средний показатель содержания золота.

2) По Маулянскому району

(1) Геологическая обстановка в районе

- Геология в этом районе состоит из: относящихся к палеозойской эре известняка, сланца, песчаника и других видов осадочных пород; проникшихся в них интрузивных гранитных пород; лампрофира и других даек. Осадочные породы, в том числе биотит, мусковит, хлорит и ставролит, подвержены метаморфизму при низких температурах и под высоким давлением, и превращены в филлит и кристаллический сланец.
- Эти пласты представляют складчатую структуру, имеющую свою ось по направлению ЗСЗ-ВЮВ и формирует глыбовую геологию по причине наличия сбросов по направлениям ЗСЗ-ВЮВ, СВ-ЮЗ и СЗ-ЮВ.

(2) Участки минерализации

- Данный район является одной из частей, составляющих Актауский участок минерализации (70 км с востока на запад, 2 - 5 км с юга на север). Рудопроявления золота в этом районе расположены на сбросах, идущих по направлению ЗСЗ-ВЮВ и на участке силикатизации. В частности, уточнены разведкой рудопроявления золота, такие как Маулянское, Бешбулакское, Таулянское, Шурское и др.
- Геохимическая разведка показала, что места аномалий, показывающих наличие Au, разбросаны по всему району и явная непрерывная связь между ними отсутствует. Места аномалий, показывающих наличие Au, разбросаны, в основном, в южной части Маулянского рудопроявления, возле Таулянского рудопроявления, в южной части Шурского рудопроявления и возле прочих уже разведанных рудопроявлений золота.

(3) Рудопроявления

- Результаты исследования масштаба Маулянского рудопроявления на поверхности земли составили 1 - 4 м ширины жилы, 900 (рудное тело №1, участок минерализации №1), 300 м (рудное тело №2, участок минерализации №2) и 200 (рудное тело №3, участок минерализации №1) протяженности. При этом содержание золота варьировались в пределах от 1 г/т до 33,4 г/т. Разведка с разбуриванием 2 скважин (скважины MJML-1 и MJML-2) была

проведена с целью, чтобы уточнить непрерывность жил в подземных пространствах этих участков. Однако, вопреки наших ожиданий, этой разведкой было выяснено лишь развитие содержащих пирит кварцевых жил в виде отдельных зон разломов в различных местах. Несмотря на то, что на глубинах 100 - 135 м под поверхностью земли была уточнена непрерывность рудных тел №3 и №2, показатели их масштаба составили, соответственно, 0,2 м и 0,3 м полезной ширины. Показатели их содержания золота были также невелики и составили 2,0 г/т и 1,6 г/т, соответственно.

- В ходе разведки, самостоятельно проведенной Узбекской стороной, в скважинах С-3, С-7 и С-8 на глубинах под поверхностью земли 16 - 90 м была уточнена непрерывность рудного тела №1 (шириной 1,2 - 1,5 м, с содержанием золота 4 - 8 г/т), а в скважинах С-6 и С-9 — непрерывность рудного тела №2 (шириной 1,7 - 1,8 м, с содержанием золота 5 - 7 г/т). Из этого можно предположить, что процесс минерализации идет интенсивнее в недрах, близких к поверхности земли, чем на больших глубинах.
- Геологическое исследование на текущий год и траншейная разведка, проведенная силами Узбекской стороны, показали, что содержание золота на всех Бешбулакском, Таулянском и Шурском рудопроявлениях - низки.

(4) Процесс минерализации

- В образцах золотосодержащих жил, которые были отобраны на Маулянском рудопроявлении, включались минералы, такие как пирит, гетит, фосгоферрит, арсенопирит, халькопирит, фалерит и др., а золото было получено в виде электрума. Такое же содержание сосуществующих минералов было также определено в образцах, взятых на Битабском рудопроявлении, которое находится в Актауской зоне минерализации на западной стороне Маулянского.
- Температура гомогенизации жидкостных включений на участках минерализации была, в основном, в пределах от 250°C до 370°C. Однако температура гомогенизации образцов кварца, которые дали показатели содержания золота, лежала в пределах от 221°C до 281°C. Эта температура была более высокой по сравнению с общепринятой температурой образования золота (в пределах от 100°C до 250°C).
- На основании распределения актуских гранитных пород, характеристик смежных рудопроявлений, результатов разведки с разбуриванием скважин и показателей температуры гомогенизации можно считать, что золотосодержащие кварцевые жилы в Маулянском районе сформировались в условиях высоких температур и под воздействиями пегматитовой минерализации. Следовательно, предполагается, что этот район, как место масштабной концентрации руды с высоким содержанием золота, не обладает достаточными условиями.

В следующем приводим рекомендации по исследованию на третий год:

Рекомендации на третий год

1) По Алтынсайскому району

- (1) Рудное тело (уточненная протяженность 32 м, ширина жилы 1,35 м, содержание золота 8,1 г/т) в северо-западной жиле (жила №8), которое было найдено в траншее (№40), выработанной силами Узбекской стороны, является массивной кварцевой жилой, подобной рудному столбу жилы №1 в штреке. Кроме того, указанная выше жила имеет выход на более высокой отметке (на высоте над морем 860 м), чем жила №1 и жила №2, что говорит о возможности отсутствия эрозийного спада рудного тела. Из этого можно надеяться на наличие продолжения жилы под ее выходом. Рекомендуется провести разведку с разбуриванием скважин с целью уточнения состояния минерализации на 230-метровом участке между траншеей и отработанным штреком, а также западного конца жилы.

2) По Маулянскому району

(1) В результате разведки с разбуриванием скважин, проведенной силами Узбекской стороны, уточнена была продолжительность процесса минерализации до глубины 16 - 90 м под поверхностью земли на участках минерализации №1 и №2. В частности, траншейной разведкой выяснено, что протяженность участка минерализации №1 составляет более 1700 м. Из этого можно предполагать, что участок минерализации №1 своей протяженностью достигает до Бешбулакского рудопроявления, которое находится на расстоянии 3 км восточнее от него. На третий год исследования рекомендуется провести разведку с разбуриванием скважин с целью выяснения состояния минерализации, главным образом, до глубины в 100 м под поверхностью земли в восточном конце рудного тела, которое было найдено в результате траншейной разведки и разведки с разбуриванием скважин, проведенных в текущем году силами Узбекской стороны.

(2) На участке №3 ещё не проведена Под земная разведка. С учетом этого на третий год исследования рекомендуется провести разведку с разбуриванием скважин с целью уточнения состояния минерализации под рудной жилой (шириной 1,0 м, с содержанием золота 6,8 г/т), которая была найдена в ходе разведки в траншее К-45, проведенной силами Узбекской стороны.

Summary

This Report summarises results of the survey in Phase II (FY1998, the second fiscal year of the survey) implemented in the Southern Nuratau Area of the Republic of Uzbekistan, under the Technical Cooperation for the Mineral Exploration. The survey was intended to clarify geologic conditions and occurrence of ore deposits in the subject area, to provide guidelines for future exploration, to revalue the known ore deposits and also to draw mining plans, thereby assisting the host country in developing its mineral resources. The field survey was executed from July to October, 1998.

During the Phase I survey, executed were satellite image analysis, collection and analysis of existing geological data, and geological reconnaissance, which covered the entire survey area of 2,000km². In addition, detailed geological survey of 5km² was carried out in the Altynsai District, as well as drilling survey of 10 boreholes totalling 2,451.1m at the Altynsai ore deposit.

In Phase II, based on the Phase I survey findings and recommendations, geological and geochemical surveys covering an area of 50km² at the Maulyan District and drilling survey of two boreholes totalling 384.1m at the Maulyan manifestation were carried out, while, at the Altynsai ore deposit, drilling survey of four boreholes totalling 790.4m was executed.

The survey findings by district and recommendations for Phase III are summarized in the following paragraphs:

1) Altynsai District

(1) Geology and ore deposit

- The District, underlain by sediments of Ordovician-Silurian System, intruded by late Permian to early Triassic lamprophyre, represents a fold structure along the axis in the WNW-ESE direction.
- Ore deposits in the District are vein-type deposits consisting of quartz veins, controlled by fracture zones with the WNE-ESE trend and those with NW-SE trend intersecting the former, and of tourmaline-quartz veins which accompany joints with the N-S trend.

(2) Ore zone

- Ore bodies of quartz veins such as the Nos. 1, 2, 5, 8 ("Northwest Vein"), 9 ("Kazanbulak Vein") and 10 ("Berkut Vein") have been confirmed in sedimentary rocks hornfelsed within an area of 2.5km in extension and 500m to 800m in width. Tourmaline-quartz veinlet zones with the N-S trend also develop in the areas where the ore zones occur.

- Bonanzas are located in zones where quartz veins at intersections of the WNW-ESE veins with the NW-SE fractures and tourmaline-quartz veinlets are concentrated.

(3) Size and continuity of ore deposit

- The drillhole MJSN-11, aimed at the eastern extension(120m) of the dominant mineralization (true width 1.6 m; Au 15.3 g/t) caught by the Phase I survey at the footwall of No.2 vein, confirmed the continuity but indicated that the mineralization is small in size and low in Au grade (1.27m in true width, grading Au 3.0 g/t).
- The Phase I and II drilling survey, including the borehole MJSN-13 aimed to examine mineralization of tourmaline-quartz veinlet zones with the N-S trend and also to examine feasibility of open pit mining, discovered low-grade gold mineralization (Au trace to 23.6 g/t) at various locations; however, the overall average of Au grade did not exceed 0.2 g/t which is insufficient for justifying the open pit mining.
- By the Uzbek drilling conducted in the subject year at the four boreholes C-47, C-50, C-53 and C-54, aimed at the lower extension of the bonanzas confirmed in the Adit No.4 at the veins Nos. 1 and 2, it has been confirmed that the mineralization degenerates below the depth of 100m (600m above sea level) under the adit. This is presumably attributable to denudation of main portions of the ore body by erosion.
- The ore body of the Northwest Vein (No.8 vein) as confirmed by the Uzbek trench No. 40 along the vein, 32m in confirmed extension, 1.35m in width, grading Au 8.1 g/t, is a massive quartz vein similar to the bonanza of No.1 vein in the adit. A 230m portion between the trench along the vein and the ancient stopes remains unexplored, as well as the portion beneath the trench (860m above sea level), which are considered to be future exploration targets.

(4) Mineralization

- Homogenization temperatures of fluid inclusions of quartz veins with the WNW-ESE and NW-SE trends and the tourmaline-quartz veinlets with the N-S trend generally range between 270°C and 370°C, no significant difference being observable between them. The quartz veins and tourmaline-quartz veinlets are inferred to have been formed during the similar period of mineralization and under similar temperature ambience.
- The occurrence of ore zones and hornfels zones, and the anomalous zones of the Uzbek airborne magnetic survey are almost corresponding to each other, which suggests the possible existence of concealed granites at shallow levels. The ore zones are inferred to have been formed by the mineralization originating in intrusion of granites.
- The mineralization of the subject ore deposit represents continuity but is variable in grade, and is low in overall grade.

2) Maulyan District

(1) Geology

- The District is underlain by Paleozoic sedimentary rocks such as limestone, slate and sandstone, intruded by granites and dikes of lamprophyre, etc. Accompanied by biotite, muscovite, chlorite, staurolite, etc., the sedimentary rocks are metamorphosed into phyllites and schists through low temperature high pressure-type metamorphism.
- These strata are folded along an axis in the WNW-ESE direction and divided in blocks by faults in the WNW-ESE, NE-SW and NW-SE directions.

(2) Ore Zone

- The District forms a part of the Aktau ore zone, 70km E-W; 2km to 5km N-S, where gold manifestations occur in fractures and silicification zones in the WNW-ESE direction. Gold manifestations have been confirmed at Maulyan, Beshbulak, Taulyan and Shur.
- Geochemical survey did not extract clear continuity between the scattered Au anomalies. The Au anomalies are spotted around the known gold manifestations -- in the southern part of the Maulyan manifestation, in the vicinity of the Taulyan manifestation and in the southern part of the Shur manifestation.

(3) Manifestation

- The extent of the Maulyan manifestation on the surface is 1m to 4m wide and 900m long (No.1 ore body of the No.1 ore zone), 300m long (No.2 ore body of the No.2 ore zone) and 200m long (No.3 ore body of the No.1 ore zone), respectively. The gold grade varies from 1 g/t to 33.4 g/t. Drilling at the two boreholes, MJML-1 and -2, aimed to examine continuity into the lower portions only confirmed that quartz veins and fracture zones develop in various portions. Although the continuities of the No.3 and No.2 ore bodies were confirmed 100m to 135m under the surface, their respective sizes and grades were 0.2m and 0.34m in true width and Au 2.0 g/t and 1.6 g/t.
- The Uzbek drilling survey on its own confirmed between 16m and 90m under the surface the continuity of the No.1 ore body (1.2m to 1.5m wide; Au 4 g/t to 8 g/t) at the boreholes C-3, C-7 and C-8, and the continuity of the No.2 ore body (1.7m to 1.8m wide; Au 5 g/t to 7 g/t) at the boreholes C-6 and C-9; the near-surface mineralization is inferred to be dominant.
- The Phase II geological survey and the subject year's Uzbek trenching survey indicate that the Beshbulak, Taulyan and Shur manifestations are low in Au grade.

(4) Mineralization

- Samples collected from gold-bearing quartz veins at the Maulyan manifestation are accompanied by ore minerals such as pyrite, goethite, lepidocrocite, arsenopyrite, chalcopyrite and sphalerite, while gold occurs as electrum. These associate minerals are

the same as those of the Bitab gold manifestation situated west of the subject manifestation, both in the Aktau ore zone.

- Homogenization temperatures of fluid inclusions at the ore zone mostly fall within the range of 250°C-370°C. The homogenization temperatures of quartz samples grading Au 1.2-2.0 g/t were 221°C-281°C, higher than the general temperature range of gold occurrence, 100°C-250°C.
- In the light of the occurrence of the Aktau granites, characteristics of the surrounding manifestations, drilling results and homogenization temperatures, gold-bearing quartz veins at the Maulyan manifestation is inferred to have been formed under high temperature ambience in the vicinity of pegmatite-type mineralization, which is considered to lack the conditions required for a high-grade, large scale gold concentration zone.

Recommendations for Phase III may be summarized as follows:

1) Altynsai District

- (1) The ore body in the Northwest Vein, or No.8 vein, as confirmed by the Uzbek trench No.40 along the vein, 32m in confirmed extension, 1.35m in vein width, grading Au 8.1 g/t, is a massive quartz vein similar to the bonanza of No.1 vein in the Adit No.4. As the altitude of the outcrop, 860m above sea level, is higher than that of the veins Nos.1 and 2, denudation of the ore body may not have advanced; therefore, its continuity into the deeper portion can be expected. It is advisable to implement drilling survey to verify mineralization in the 230-m portion between the trench and the ancient stopes in the east and in its western extension.

2) Maulyan District

- (1) It has been confirmed by the Uzbek drilling survey that the mineralization continues from 16m to 90m below the surface at the ore zones Nos. 1 and 2. Especially at the No.1 ore zone, the Uzbek trenching survey revealed that the mineralization continues over 1,700m in extension, which is inferred to continue further into the Beshbulak manifestation situated 3km east of the subject manifestation. It is advisable, therefore, to implement drilling survey to verify mineralization, mainly up to 100m under the surface, in the eastern extension of the ore bodies confirmed by the Uzbek trenching and drilling surveys.
- (2) The lower portion of the No.3 ore zone remains unexplored. It is advisable to implement drilling survey to verify mineralization in the portion beneath the vein, 1m wide, grading Au 6.8 g/t, as confirmed by the Uzbek trench K-45.

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PART I GENERALITIES

Chapter 1 Introduction

1-1 Antecedents of the Survey

The subject survey of mineral resources in the Southern Nuratau Area of the Republic of Uzbekistan was conducted by the Japanese Government to comply with the request of the Uzbek Government, in conformity to the Scope of Work agreed to between the two governments on June 14, 1997.

The survey was intended to clarify the geological conditions and mineral resources in the mentioned area, to provide the guidelines for future exploration and to reevaluate the known ore deposits, thereby assisting development of the mineral industry of the host country. It was also aimed to promote technology transfer to the host nation's organizations concerned through the collaborative survey.

1-2 Conclusions of Phase I Survey and Recommendations

1-2-1 Conclusions of Phase I survey

Conclusions of the Phase I survey may be summarized as follows:

- (1) The satellite images produced from the LANDSAT TM data demonstrates the geologic units and tectonic structure, proving to be effective for the geological interpretation for the survey area.
- (2) From within the survey area, ore deposits and manifestations at 13 locations of gold-silver, niobium-tantalum, tungsten-molybdenum and iron-manganese have been extracted. Mineralization in the subject area is considered to have host rocks of Lower Cambrian to Middle Devonian System and to be related with igneous activity of the dikes which intruded from Silurian to Triassic time and of the granitic rocks which intruded from Carboniferous to Permian time, and also related with fractures with the WNW-ESE, NE-SW and NW-SE trends.
- (3) Of the mentioned ore deposits and manifestations at 13 locations, the Maulyan (Au) manifestation and Altynsai (Au) deposit are considered to require further exploration.
- (4) At the Maulyan manifestation, mineralization accompanies quartz veins and silicification zones along some ten of fracture-silicifications zones extending in the WNW-ESE direction. So far, three ore zones, 1m to 4m wide and 150m, 200m and 800m long, have been found, whose gold grades range from 1 g/t to 18 g/t.
- (5) The gold deposits in Altynsai District are vein-type deposits consisting of quartz veins controlled by fracture zones with the WNW-ESE and NW-SE trends and tourmaline-quartz veins accompanying joints with the N-S trends. More than 20 ore zones including the veins Nos. 1, 2, 5, 8, 9 and 10 have been confirmed, so far.

- (6) The drilling has caught relatively good mineralization (true width 0.2m -1m; Au 2 - 20 g/t) on the hanging side of the No.1 vein and in the No.5 vein while, at the borehole MJSN-8, dominant mineralization (true width 1.6m; Au 15.3 g/t) has been confirmed in the lower part of the No.2 vein. However, the drilling aimed at the portion beneath a bonanza as confirmed by the Adit No.4 along the veins Nos.1 and 2 only caught low-grade mineralization.

1-2-2 Recommendations of Phase I survey

Based on the conclusions of the Phase I survey, the following were recommended for the Phase II survey:

1) Maulyan District

Execute drilling survey at the Maulyan manifestation, in order to clarify mineralization in the deep of the ore body as confirmed by the Uzbek trenching survey. Also execute detailed geological survey in the area around the Maulyan manifestation that includes the Beshbulak and Taulyan gold manifestations.

2) Altynsai District

- (1) Execute drilling survey to verify mineralization in the western extension and the deeper portion of the No.2 vein, where the Phase I drilling survey (MJSN-8) caught good mineralization 250m under the surface to ascertain the mineralization continuing into the deep.
- (2) Execute drilling survey aimed at the lower extension of the bonanza (135m in extension; 2.29m in average width; Au 15.7 g/t) of the No.1 vein as confirmed at the Adit No.4.
- (3) Execute drilling survey to verify mineralization in the deep of the veins Nos. 5, 6, 7, 11 and 12 in the southern ore zone.
- (4) Execute drilling survey aimed at the lower portions of the zones where veinlets concentrate, in order to examine the feasibility of open pit mining of tourmaline-quartz veinlets with the N-S trend.
- (5) Execute electro-magnetic survey by the TEM method to clarify shapes of a granite stock presumed to be concealed under the tourmaline-quartz veinlets with the N-S trend and of the tourmaline-quartz veinlets developing in the surroundings.

1-3 Outline of Phase II Survey

1-3-1 Survey area

The Southern Nuratau area is situated about 330km southwest of Tashkent, the capital city, and about 100km west-northwest of Samarkand, the ancient capital. Topographically,

the area consists of a mountainous zone in the north, alt. 1,000m to 2,000m above sea level and a gently undulating hill zone, alt. 600m to 900m.

1-3-2 Purpose of the survey

During Phase II, carried out were the geological and geochemical surveys covering an area of 50km² at the Maulyan District and drilling survey of two boreholes totalling 384.1m at the Maulyan manifestation, as well as drilling survey of four boreholes totalling 790.4m at the Altynsai deposit.

These surveys were aimed at:

- 1) clarifying relationship of the geology and tectonic structure with mineralization by means of the geological survey at the Maulyan District;
- 2) clarifying relationship between mineralization and geochemical anomalies by means of the geochemical survey at the Maulyan District; and,
- 3) Sampling and confirming ore reserves and sampling by means of drilling at the Altynsai and Maulyan Districts so that stratigraphy and the occurrence of ore deposits may be verified and described.

1-3-3 Methods of the survey

1) Geological survey

The geological survey in the quantities indicated in Table I-1-1 was conducted at the Maulyan District. The base camp for the survey was placed at a hotel in Millbazar.

Reconnaissance for the geological survey was conducted with a 1:10 000-scale route map enlarged from the 1:25 000-scale geological map. Outcrops of particular importance were sketched at 1:100 to 1:200 scales and photographed in color. Survey findings were incorporated in the 1:10 000 geological map.

Simultaneously with the geological survey, sampling of various types in the quantities indicated in Appendix 2-1 was carried out for laboratory testing.

2) Geochemical survey

At the Maulyan District, the geochemical survey in the quantities indicated in Table I-1-1 was carried out. Analysis of 200 pieces of rock samples collected by the Uzbek geologists, in principle, at a rate of four pieces per km² was conducted.

3) Drilling survey

At the Altynsai and Maulyan Districts, drilling survey in the quantities indicated in Table I-1-1 was carried out. The drilling work was undertaken by an appointed local contractor.

After core identification and photographing, the split cores were collected for chemical

assay and sampled for various laboratory testing. Core identification results are demonstrated in geologic core logs at a 1:200 scale.

1-3-4 Organization of the survey team

1) Survey team

Japan		Uzbekistan	
Name	Entity	Name	Entity
Katsuji Fukumoto (Leader)	MINDECO	A.Abdurakhmanov (Coodinator)	SCG
Toshio Inoue (Geologist)	//	G.E.Kamagurov (Coodinator)	//
		A.T.Zakirov (Coodinator)	//
		A.L.Ogarkov (Geologist)	//
		N.E.Kozarez (Geologist)	//
		Xamidoraev (Geologist)	SKG
		N.Akhmedov (Coodinator)	//
		M.B.Karimov (Coodinator)	ZE
		Khaidov (Coodinator)	ZA
		Zalyotov (Drilling Engineer)	SKG

2) Field inspection

Koji Hirai MMAJ

MMAJ : Metal Mining Agency of Japan

SCG : State Committee of Geology and Mineral Reseves

SKG : Samarkandgeology

ZE : Zarafshan Expedition

ZA: Zarmitan Expedition

MINDECO : Mitsui Mineral Development Engineering Co., Ltd.

1-3-5 Period of the survey

	1998						1999	
	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
Planning and Preparation								
Field survey	14	—————			23			
Tests and analysis			—————					
Compilation of report				24	—————			26

Table I -1-1 Outline of the Survey

Items	Quantity			
Geological survey (Maulyan district)	Survey area	;	50 km ²	
	Length of route	;	108 km	
Drilling survey (Altynsai deposit)	Hole No.		Length	Dip Direction
	MJSN-11	-	280.1m	-75° N 10° E
	MJSN-12		220.0m	-75° S 10° W
	MJSN-13		128.0m	-75° S 80° E
	MJSN-14		162.3m	-75° S 10° W
Drilling survey (Maulyan deposit)	MJML-1		201.1m	-75° S 20° W
	MJML-2		183.0m	-75° S 20° W
	Total 6 holes		Total length 1,174.5m	

Chapter 2 Geography of Survey Area

2-1 Location and Access

The survey area is situated about 330km southwest of Tashkent, the capital city, and about 100km west-northwest of Samarkand, the ancient capital. The area spreads over the Navoi and the Samarkand Regions and can be reached by car from Tashkent via Samarkand. From Tashkent to Samarkand, east of the survey area, it takes about 4.5 hours (380km), and about 2 more hours (155km) from Samarkand to the Altynsai deposit, where the Altynkazgan Geological Party of the Zarafshan Expedition has installed its base (Fig. I-1). The roads are paved, except for a 5km portion near Altynsai. Maulyan district is situated 30km east of the Altynsai district. It takes about 1 hour (45km) by car from Altynsai deposit to the Maulyan manifestation, where the Zarmitan Expedition has been prospecting.

2-2 Topography and Drainage Systems

In the north of the survey area, lies the Aktau Range consisting of mountains of 1,000 - 2,000m in altitude, which forms the western edge of the Southern Tien-Shan Mountains. The steep mountain country extends in the WNW-ESE direction. Southern part of the survey area, forming foothills of the Aktau Range, has gently undulating topography between 600m and 900m in altitude. In the southwest, the Karatau Mountains spread in the WNW-ESE direction, whose altitudes range from 600m to 1,200m.

During the dry summer seasons, permanent water flow can be seen only in large streams in the area, while there are many dried river beds where water flows only in the rainy seasons in winter and spring. The drainage systems represent dendritic ~ parallel patterns stretching in the NS ~ NNE - SSW directions.

2-3 Climate and Vegetation

The area has a typically continental dry climate, characterized by dry hot summer and cold winter. The average monthly temperature drops to the lowest in January (min. -20°C) and rises to the highest in July (max. +40°C).

The precipitation is high in winter and spring. The spring precipitation accounts for 30% of the annual total of 300mm to 350mm.

Excepting in large river basins, vegetation is scanty due to the desert climate; therefore, the area assumes an outlook of rock desert.

Along large rivers with constant stream, vegetations such as poplars, willows, mulberries and some fruit trees are seen, as well as shrubs. Grass and shrubs can be seen all over the area, which however wither away before August except along some streams. The area

is inhabited by some animals, though small in number, such as rats, squirrels, foxes and wolfs, as well as some birds and reptiles including snakes, lizards and tortoises.

Chapter 3 General Geology

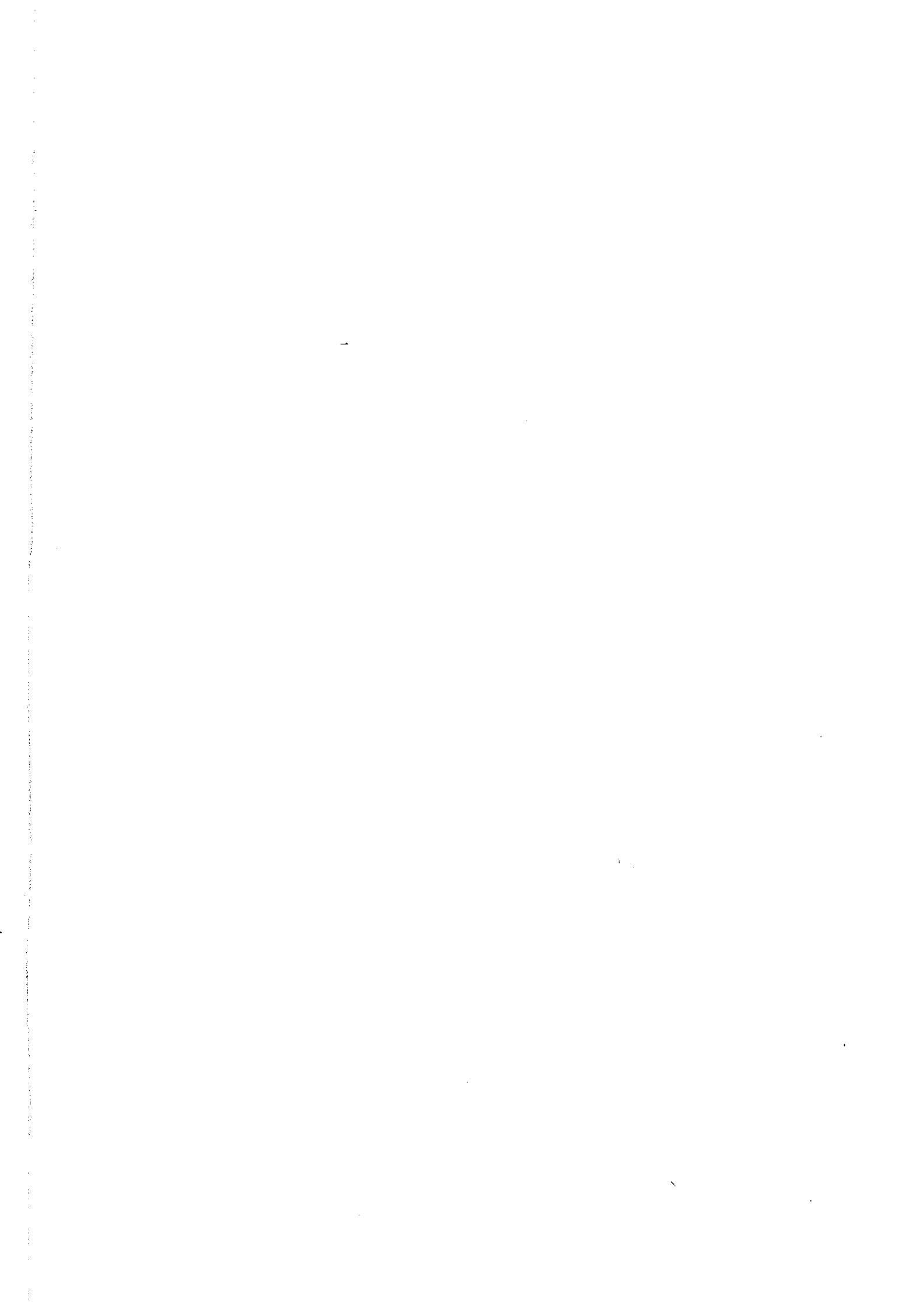
The survey area is underlain by the basement rocks consisting of Paleozoic sedimentary rocks and granitoids and by the blanket beds consisting of sediments of the Senonian Series of Upper Cretaceous to Quarternary Systems (Fig. I-3-1) . The subject area pertains to the Zarafshan-Turkestan Zone of the Southern Tien-Shan Tectonic Belt; the regional tectonic structure of the basement rocks represents the WNW-ESE trend (Fig. I-3-2) .

The sedimentary rocks that constitute the basement are classified into 13 formations of lower Cambrian to middle Carboniferous age and each formation lies mainly in fault contact. These formations occur in belts with the WNW-ESE trend along the extension of the Aktau Range and the Karatau Mountains, accompanied by remarkable folding. The middle Carboniferous to early Permian Aktau granites, as well as the early Permian Karatau granites, intrude into the sedimentary rocks, forming the main bodies of the Aktau Range and of the Karatau Mountains, respectively. Igneous rocks include, besides the granites, Silurian-Triassic lamprophyre, diorite and gabbro dikes.

The strata of Lower Cambrian to Upper Silurian System, composed of thick terrigenous sediments, mainly slate and sandstone, are widespread in the Karatau Mountains and also in the Aktau Range. The strata of Upper Silurian to Middle Devonian System are mainly of thick limestone. In the west of the survey area, these occur in the Aktau Range while, in the east of the area, along the anticlinorium south of the same Range. The Middle Carboniferous System, mainly conglomerates and coarse-grained sandstone, occurs in small blocks aligned in the WNW-ESE direction in the northwestern part of the survey area.

Post-Mesozoic sediments which form the blanket beds occur with very gentle inclination chiefly in the flatlands north of the Aktau Range and south of the Karatau Mountains. The Senonian Series of Upper Cretaceous System and the Eocene Series of the Paleogene System are composed of neritic sediments, mainly marl, siltstone, limestone, sandstone and coquinite. The Neogene System consists of molasse-type sediments, mainly semi-consolidated conglomerates, sandstone and clay, whereas the Quarternary System consists of alluvial fan sediments, terrace sediments, stream sediments, aeolian sediments, etc.

Ore deposits and manifestations in the area are mainly gold-silver vein type, originated in Silurian to Carboniferous dikes and Carboniferous to Permian granites.



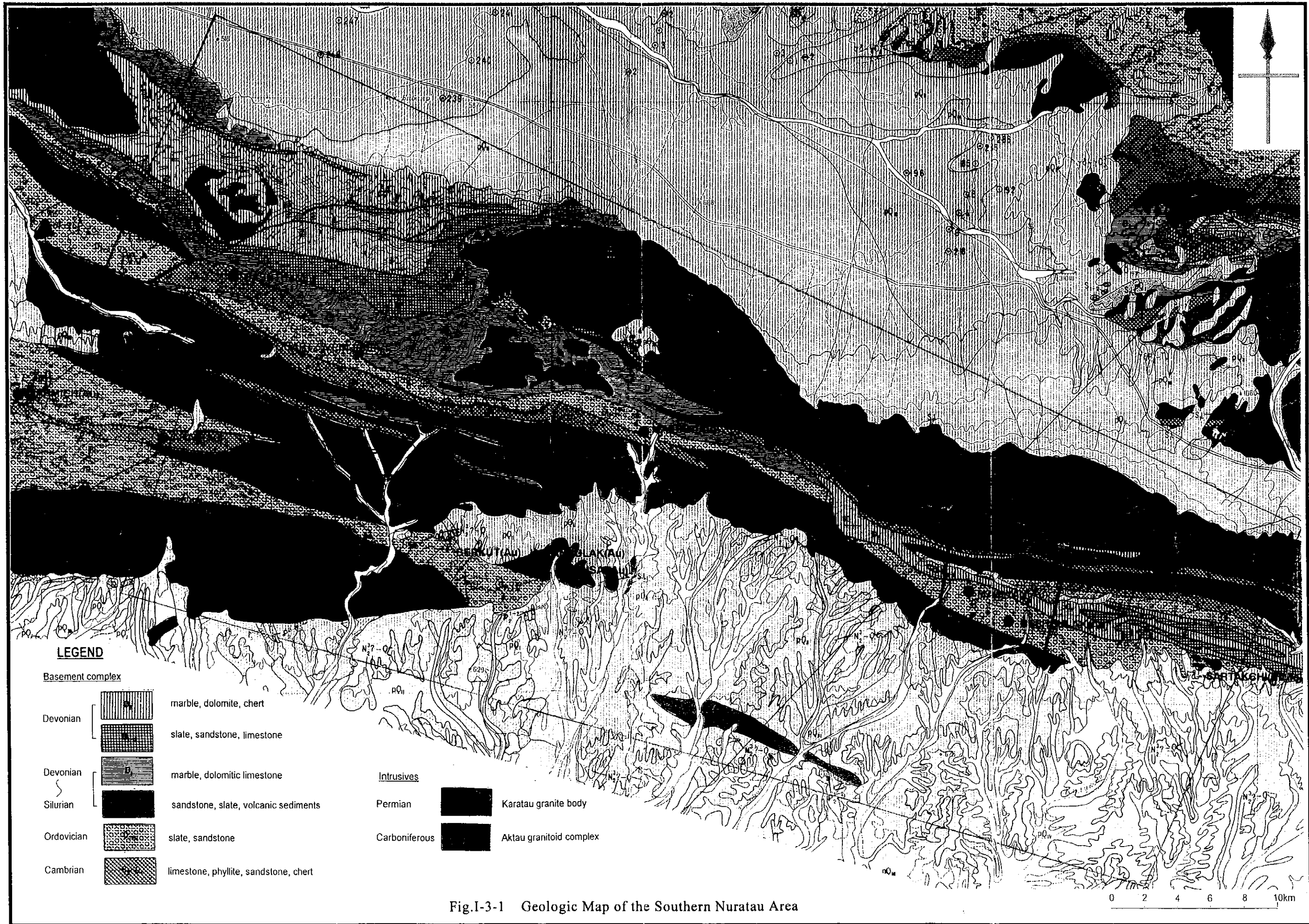


Fig.I-3-1 Geologic Map of the Southern Nuratau Area

0 2 4 6 8 10km

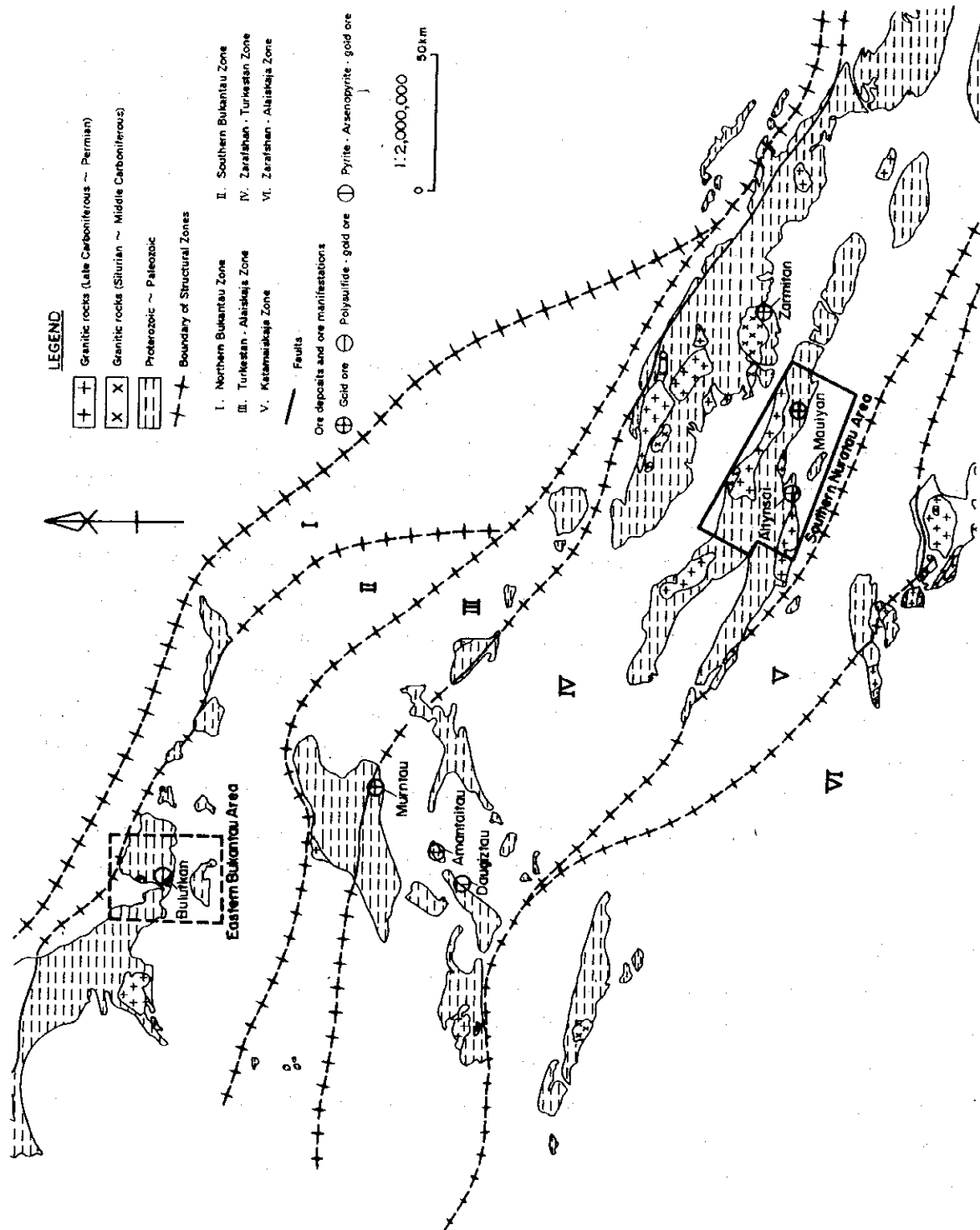


Fig.I-3-2 Structural Zones of the Western Uzbekistan